UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 1
5 Post Office Square, Suite 100
Boston, MA 02109-3912

SENT VIA ELECTRONIC MAIL

May 27, 2022

Whitney Marsh
Environmental Manager
Revolution Wind, LLC
56 Exchange Terrace, Suite 300
Providence, RI 02903

Re: Revolution Wind, LLC Outer Continental Shelf Air Permit Application – Request for Additional Information

Dear Ms. Marsh:

The U.S. Environmental Protection Agency, Region 1 (EPA) has conducted an initial review of your permit application under the Outer Continental Shelf Air Regulations at 40 CFR part 55 for the Revolution Wind offshore wind farm project. The permit application from Revolution Wind, LLC, received by the EPA on May 1, 2022, proposes to install and operate up to 100 wind turbine generators and supporting equipment for the purposes of generating electricity. The project is located approximately 7.5 nautical miles southwest of Nomans Land Island, Massachusetts.

The EPA has reviewed your May 1, 2022, permit application and has determined that additional information is necessary to continue processing the application. The regulations at 40 CFR § 55.6(a)(1)(i) provide for the applicant to submit all information necessary to perform any analysis or make any determination under § 55.6. At this time, the EPA cannot find the application to be complete until the additional information is received. The EPA is requesting that Revolution Wind, LLC submit the information requested in the enclosure to this letter by June 30, 2022.

Please note that as the EPA develops the draft permit and supplemental documents, we may identify further information that will be needed to enable the Agency to make permit decisions, including information that may be needed in response to any public comments on the draft permit.

We look forward to continuing to work with you on the Revolution Wind project. If you have any questions or would like to schedule a discussion of EPA's comments, please contact Eric Wortman of my staff at 617-918-1624 or wortman.eric@epa.gov.

Sincerely,

PATRICK BIRD

Digitally signed by PATRICK BIRD
Date: 2022.05.27 11:01:36 -04'00'

Patrick Bird, Manager
Air Permits, Toxics, & Indoor Programs Branch

Enclosure

cc: Mark Roll, Revolution Wind, LLC (via email)
Marc Wallace, Tech Environmental (via email)
Kathrine Mears, Tech Environmental (via email)

Enclosure

Additional Information Request for Revolution Wind, LLC's
May 1, 2022 OCS Air Permit Application

The regulations at 40 CFR § 55.6(a)(1)(i) provide for the applicant to submit all information necessary to perform any analysis or make any determination under § 55.6. At this time, the EPA is seeking the following additional information to assist our permit engineers in understanding your project and developing a comprehensive permit.

1. In Appendix A to the May 1, 2022, application, Revolution Wind, LLC (RW) provided its view of how the Outer Continental Shelf (OCS) source should be characterized for the wind farm. RW stated that the Wind Turbine Generators (WTGs) will not contain permanent generator engines and will not have sulfur-hexafluoride (SF-6) within the switchgear, and that the WTGs therefore do not have emissions during any phase of the project. RW asserted that the WTGs should not be considered part of the OCS source in either the construction or operation phase. RW indicated that if future discussions with EPA support its proposed approach to defining the OCS source, RW would submit a revised application.

   As indicated in EPA's April 21, 2022, letter to RW providing comments on the modeling protocol, EPA considers all offshore substations and WTGs associated with a particular wind farm project as part of a single OCS facility. EPA notes that according to RW, RW calculated the potential to emit (PTE) of the project by considering the WTGs part of the OCS source, which is consistent with EPA precedent. Therefore, EPA is not commenting on RW's analysis in Attachment A of the application at this time.

2. The application does not include an air quality modeling analysis demonstrating compliance with the National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) increments, preconstruction ambient air monitoring data, or additional impact analyses, including analysis of impacts on visibility and Class I air quality related values (AQRVs). EPA provided comments on a draft modeling protocol to RW on April 21, 2022, but has not received a revised modeling protocol or a complete modeling report detailing the air quality modeling analysis, which is a required component of the application. EPA understands that RW intends to submit a revised modeling protocol for further agency review, and will provide the necessary air quality modeling analysis as an application update. EPA is unable to determine the application complete until the required components are received.

3. As indicated in EPA's April 21, 2022, modeling protocol comments and previous discussions with RW, EPA has preliminarily determined that the Revolution Wind and South Fork Wind offshore wind farms comprise a single stationary source for the purposes of Clean Air Act (CAA) permitting. As such, the application should follow the New Source Review (NSR) procedures for modifications, and the PTE for permitting

applicability should be evaluated against the significant emission rates in 40 CFR § 52.21.

4. Please provide Appendix C of the application titled Air Emissions Calculations and Methodology. Appendix C should include calculations with emission factors for all emission units identified in the application to support statements regarding emission estimates for the construction and operation phases. The calculations should show all parameters necessary to complete the calculation, such as maximum engine power rating, loading factors, hours of operation, number of sources, etc. Please provide all relevant assumptions and calculations supporting the selection of each emission factor.[1] A copy of the supporting emissions specifications, engine certifications, or stack test data should be provided when available. Emissions data generated from BOEM's emission estimating tool should also be provided. Any assumptions used to limit the potential-to-emit, such as hours of operation or loading factors, should be clearly explained. In addition, emission factors based on a tier standard in EPA or MARPOL Annex VI regulations should be clearly identified.

5. The application indicates that emissions were calculated using the centroid of the WTG locations. Although EPA has allowed the use of a centroid approach to calculate emissions on a case-by-case basis in other OCS permitting actions, EPA's regulations at 40 CFR part 55 do not define emissions from OCS sources based on the centroid of the project. If RW elects to use a centroid approach for the calculation of to-and-fro vessel emissions for PTE purposes, the application should provide a rationale for use of this approach that is consistent with the definition of "OCS source" in CAA section 328(a)(4)(C) and EPA's regulatory definition of "potential emissions" in 40 CFR § 55.2. If, for example, using the centroid approach would result in a calculation of vessel emissions approximately equivalent to the calculation resulting from assessment of each vessel's emissions whenever it is located within 25 nautical miles of the lease area boundary, EPA may take this information into account in determining whether the calculation of the OCS source's "potential emissions" is consistent with CAA and part 55 requirements.

6. Section 3.3 of the application states that RW is requesting federally enforceable emission limits for the project's construction and Operation and Maintenance (O&M) activities. However, the application does not identify the activities for which RW is seeking federally enforceable emission limits or propose any emission limits on particular activities. RW should provide EPA with its proposal for each requested emission limit and the basis for each requested emission limit along with RW's proposed monitoring, recordkeeping, and reporting requirements for each proposed emission limit.

[1] The calculations and assumptions used to derive the NO_x and VOC emission factors (in g/kW-hr) are important because, many times, the tier standard(s) that applies to a given engine are presented as NO_x + NMHC or NMHC. Also, the tier standard(s) contain emission standards for PM emissions, and not for PM_{10} and $PM_{2.5}$ emissions.

7. The PTE in Tables 4-1 and 4-2 of the application is inconsistent with the emissions estimates provide in RW's February 17, 2022, modeling protocol. Please explain the discrepancy and make any necessary corrections to the application and modeling protocol.

8. Section 2.1.10 of the application indicates that construction is anticipated to begin in 2023 with installation of onshore components and initiation of seabed preparation activities. Please provide the anticipated construction timeline for the activities that will be subject to the part 55 permit, including the anticipated date of the first activity or piece of equipment that will constitute an OCS source as defined in 40 CFR § 55.2. Note that per § 55.6(b)(4), an approval to construct shall become invalid if construction is not commenced within 18 months after receipt of such approval, if construction is discontinued for a period of 18 months or more, or if construction is not completed within a reasonable time.

9. Based on the application, there will be two (2) identical generator set engines ("engines"), each rated at 597 kW, installed permanently on the two offshore substations ("OSS") (one on each OSS). These engines will be operated as non-emergency engines during the commissioning period of the project. Section 4.1.1 of the application states that RW plans to continue to use the two engines during O&M for periods of non-emergency use up to 200 hours per year. It also states that because the generators will be primarily used for emergency conditions, the number of hours for emergency operations has not been estimated. Please note that both the federal and Massachusetts regulations define the PTE to be the maximum capacity of a stationary source to emit a pollutant under its physical and operational design, and provide that any physical or operational limitation on the capacity of the source to emit a pollutant shall be treated as part of its design if the limitation or the effect it would have on emissions is federally enforceable.[2] As described above, the PTE for each of the two engines should assume the maximum capacity, or worst-case scenario, for all anticipated operating scenarios or be calculated based on 8,760 hours per year of operation. The PTE should be determined based upon an estimate of the maximum number of hours the engine could operate, taking into account all of the scenarios under which the engines may operate. If RW determines that 200 hr/yr/each engine is a reasonable and realistic worst-case scenario that would cover all of the engines' expected operating scenarios, RW should update its application to clearly indicate that these are maximum operating hours per year. Please note that any estimates of annual hours of operation RW uses in its calculation may provide the basis for permit conditions (e.g., an annual tons per year emission cap or limit on hours of operation on these engines) to ensure that the source's operations are consistent with the information presented in the application.

10. Section 2.2 and 4.1.1 of the application indicate the generator set engines to be installed on each OSS have a nameplate capacity of 597 kW. However, Section 3.2.5 of the application states the generators are approximately 600 kW. EPA notes that the

[2] For complete definitions, *see, e.g.*, 40 CFR § 55.2 (definition of "potential emissions"); 40 CFR § 52.21 (definition of "potential to emit"); and MassDEP 310 C.M.R. 7.00, Definitions (definition of "federal potential to emit").

regulations in 40 CFR 1042.101(a) require compliance with Tier 4 standards for engines at or above 600 kW, and Tier 3 standards for engines less than 600 kW. Section 4.1.1 indicates that Tier 3 emission factors were used to estimate emissions from the generators. When it becomes available, please provide a copy of the EPA certificate of conformity showing the tier level the two generator set engines rated at 597 kW are certified to meet. Note that EPA may request the EPA certificate of conformity to be included in the permitting record before commencing the public notice and comment period for the draft permit.

In addition, EPA notes that in the January 18, 2022, final permit for the South Fork Wind Farm, EPA identified the Best Available Control Technology (BACT)/Lowest Achievable Emission Rate (LAER) for the 200-kW generator engine on the OSS to be Tier 4 engine requirements in 40 CFR part 1039. Furthermore, the application for Ørsted's Ocean Wind project in EPA Region 2 indicated that the engines on the OSS would meet the Tier 4 requirements in part 1039. RW's BACT and LAER analysis for the 597-kW engine should include a discussion of the application of the engine requirements in part 1039 for the 597-kW engine.

11. In Section 6.3 of the application, RW's provides information regarding the applicability of the control requirements in the California State Implementation Plan (CA SIP) for certain defined vessels to have engines certified to at least Tier 2 standards. RW provides exemptions from the CA SIP control requirements , and states that some of the vessels used in the project would be Ocean-Going vessels (as defined in the CA SIP) and exempt from these requirements. EPA notes that in the final permit for the Vineyard Wind 1 and South Fork Wind offshore wind farms,[3] the EPA identified within the permit that certain defined vessels even if foreign flagged, (e.g., feeder jack-up vessel and certain crew and supply vessels), would be subject to limits as stringent as the CA SIP control requirements and as part of our LAER analysis,[4] we found all engines would need to meet at least the emission standards for Tier 2 engines in 40 CFR § 1042 – Appendix I (formerly 40 CFR § 94). RW should update the application to indicate which vessels identified in Table 2-5 (Description of Vessels and Equipment During Construction) and Table 2-10 (Description of Vessels and Equipment Used During Operations and Maintenance) would be subject to the CA SIP control requirements and which vessels may be exempt.[5]

[3] The permits, fact sheets, and administrative record for the Vineyard Wind 1 and South Fork Wind permits are available online at https://www.epa.gov/caa-permitting/epa-issued-caa-permits-region-1.
[4] 310 CMR 7.00, Appendix A defines LAER as for any source, the more stringent rate of emissions based on the following: (a) the most stringent emissions limitation which is contained in any state SIP for such class or category of stationary source, unless the owner or operator of the proposed stationary source demonstrates that such limitations are not achievable; or (b) the most stringent emissions limitation which is achieved in practice by such class or category of stationary source.
[5] Vessels that are not subject to these control requirements may be subject to other BACT/LAER requirements in the permit.

12. Section 2.1.8 of the application indicates that 37 kW "on-vessel" generators will be used to temporarily power the WTGs during commissioning and during the installation of the inter-array cables. However, the application does not indicate whether the vessel on which these generators are located will be operating as an OCS source as defined in 40 CFR part 55. Please provide the OCS source status for each vessel during which time the 37 kW engines will be operated, including RW's rationale for why the vessel may or may not be operating as an OCS source during those times.

13. Section 6.5.2.1 of RW's application states that the use of selective catalytic reduction (SCR) control technology is technologically infeasible for emergency generators and for non-emergency engines on transport vessels. However, RW's BACT analysis does not discuss the application of SCR for the 597-kW non-emergency generators located on the OSSs. The EPA has identified at least one manufacturer that produces a Tier 4 marine engine that relies on SCR control to meet the Tier 4 NO_x emission standard. See https://www.cat.com/en_US/by-industry/marine/tier-four/the-technology-explained.html. Therefore, RW's BACT and LAER analysis for the non-emergency generators on the OSS should evaluate the use of SCR as an option for BACT and LAER.

14. Section 4.1 (at the top of page 28) of the application states that some of the specific vessels to be used have been identified by RW and that vessel-specific NOx emission factors were used based on the vessels tier rating. However, the application does not contain specific vessel or engine information necessary to determine compliance with applicable regulations identified in Section 6.2 of the application. RW should provide specific emissions unit information for each emission unit associated with the project, when available, as necessary to determine compliance with applicable regulations (e.g., construction and manufacture date of engine, engine power rating, power density, engine displacement, etc.). RW should also provide information regarding specific vessels used for the project, particularly for the large NOx emission sources that will operate as OCS sources. EPA understands that based on recent media articles, specific vessel engine information is available for the RW project. [6]

15. Section 2.2.3 of the application indicates that each OSS will use SF_6 for insulation purposes. [7] However, RW's BACT analysis does not evaluate the use of SF_6 free or SF_6 alternative switchgear for the equipment on each OSS. RW should provide a BACT analysis that addresses SF_6 emissions, including fugitive emissions.[8] We recommend that

[6] *See* technical articles available at https://us.orsted.com/news-archive/2021/06/contract-to-charter-offshore-wind-turbine-installation-vessel and https://us.orsted.com/news-archive/2022/03/construction-begins-on-chouest-vessel.
[7] SF_6 is used as an electrical and thermal insulator in electrical equipment, but it is also a powerful greenhouse gas, having a global warming potential (GWP) of 23,500 times that of carbon dioxide (CO_2). SF_6 has the highest GWP of all greenhouse gases addressed by the Intergovernmental Panel on Climate Change (IPCC) inventory protocols.
[8] BACT applies to the fugitive emissions for a non-category PSD source, such as RW (*see* 40 CFR § 52.21(b)(1)(iii) for a list with source categories), once it is determined that the source is subject to PSD without taking into account the fugitive emissions.

RW, as part of the BACT analysis for SF_6 emissions, consider the option of using SF_6-free or SF_6 alternative switchgears.

16. Section 6.5.1.1 of the application broadly states that for the engines used during the construction and O&M phases, BACT/LAER is considered to be engine design and good combustion practices. RW states that BACT/LAER should include work practices such as reduced idling when possible, using low-sulfur fuel oil, conducting regular maintenance on the engines, and using engines meeting EPA certification or International Maritime Organization standards, where possible, and using engines that meet any applicable New Source Performance Standards (NSPS) or Reciprocating Internal Combustion Engines (RICE) Maximum Achievable Control Technology (MACT) regulations.

    RW continues to state in Section 6.5.6 that although RW will request the highest tiered vessel, the Project may be limited to those vessels that are owned and operated by the awarded contractor. RW states that the vessels needed for construction of the Project are extremely specialized, and in high demand due to competing wind development area projects worldwide. RW indicated that waiting for the "highest tiered" engine at the time of the scheduled deployment would affect the construction timetable as the construction schedule is carefully sequenced, and delaying the mobilization of a vessel since it did not have the highest tier engine could jeopardize the overall schedule significantly.

    For vessels used during the construction and operation of the wind farm, EPA understands there is variability in vessel engines tier levels in the worldwide fleet of vessels available for the offshore wind industry. Thus, use of the "highest tiered" engine available at the time of deployment is an option that should be evaluated under RW's BACT/LAER analysis.[9]

    Furthermore, the RW project is covered under Title 41 of the Fixing America's Surface Transportation Act (FAST-41), with an already-established final permit decision date, and an already-estimated construction and operation schedule in place. If there are specific facts that would prevent RW from securing contracts for low-polluting vessels, we request that RW describe those facts. We believe the public would benefit from such information and clarification, in the context of a future public review of the draft OCS air permit for the RW project. Thus, EPA recommends that RW include in its BACT and LAER analysis the rationale supporting RW's overall approach to securing contracts for the vessels needed for construction and O&M.

    Further, based on our brief review of several technical articles,[10] Ørsted, the parent company of Revolution Wind, LLC and parent company of several other planned wind

[9] Please refer to the South Fork and Vineyard Wind 1 OCS air permits as examples.
[10] *See* technical articles available at https://us.orsted.com/news-archive/2021/06/contract-to-charter-offshore-wind-turbine-installation-vessel, https://us.orsted.com/news-archive/2022/01/rhode-island-shipyards-to-build-five-new-offshore-wind-crew-vessels, and https://us.orsted.com/news-archive/2022/03/construction-begins-on-chouest-vessel.

projects offshore the United States and abroad, is engaged in chartering and constructing installation/construction vessels and support/service vessels that it plans to use for the construction and O&M of RW and other US wind farm projects. Based on these articles, it appears that these vessels will use very low-polluting engines. We recommend updating the application with information relevant to the new vessels referenced in those articles for the RW project, and explaining why Ørsted does not plan to use any of the new vessels for the Revolution Wind project, if that is the case.